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Claims 1-163 Cancelled

CLAIMS

164. (Previously Presented) A complimentary metal oxide semiconductor (CMOS) integrated circuit, comprising:

a transmitter including,

a tunable oscillator having a tuning input,

a mixer having a first input coupled the oscillator, a second input, and an output, and

a phase detector having a first input coupled to the mixer output, a second input, and an output coupled to the tuning input; and

a local oscillator coupled to the second input of the mixer

165. (Previously Presented) The CMOS integrated circuit of claim 164 wherein the oscillator comprises a voltage controlled oscillator.

166. (Previously Presented) The CMOS integrated circuit of claim 164 wherein the transmitter further comprises a bandpass filter coupled between the mixer output and the first input of the phase detector.

167. (Previously Presented) The CMOS integrated circuit of claim 166 wherein the transmitter further comprises a limiter coupled between the bandpass filter and the first input of the phase detector.

168. (Previously Presented) The CMOS integrated circuit of claim 164 wherein the transmitter further comprises a charge pump coupled between the phase detector output and the tuning input of the oscillator.

169. (Previously Presented) The CMOS integrated circuit of claim 164 wherein the transmitter further comprises a loop filter coupled between the phase detector output and the oscillator tuning input.

170. (Previously Presented) The CMOS integrated circuit of claim 164 wherein the oscillator comprises a voltage controlled oscillator, the CMOS integrated circuit further comprising a bandpass filter coupled to the mixer, a limiter coupled between the bandpass filter and the first input of the phase detector, a charge pump coupled to the phase detector output, and a loop filter coupled between the charge pump and the tuning input of the oscillator.

171. (Previously Presented) The CMOS integrated circuit of claim 164 wherein the mixer comprises a subsampling mixer.

172. (Previously Presented) The CMOS integrated circuit of claim 171 wherein the mixer comprises a track and hold circuit coupled to the inputs of the mixer and the output of the mixer, and a bandpass circuit coupled to the first input of the mixer and the output of the mixer.

173. (Previously Presented) The CMOS integrated circuit of claim 172 wherein the mixer further comprises an input circuit disposed between the first input of the mixer and the track and hold circuit.

174. (Previously Presented) The CMOS integrated circuit of claim 172 wherein the mixer further comprises a buffer disposed between the track and hold circuit and the output of the mixer.

175. (Previously Presented) The CMOS integrated circuit of claim 172 wherein the bandpass circuit comprises an inductor coupled to the first input of the mixer and a capacitor coupled to the output of the mixer.

176. (Previously Presented) The CMOS integrated circuit of claim 172 wherein the track and hold circuit comprises a switch between the first input of the mixer and the output of the mixer, the switch being adapted for control by a signal applied to the second input of the mixer from the local oscillator.

177. (Previously Presented) The CMOS integrated circuit of claim 176 wherein the switch comprises a transistor having a gate coupled to the second input of the mixer, a source coupled to the first input of the mixer, and a drain, and wherein the bandpass circuit comprises a capacitor coupled to the drain, and an inductor coupled to the source.

178. (Previously Presented) The CMOS integrated circuit of claim 177 wherein the capacitor and inductor cooperate to provide a time constant related to a signal frequency applied to the first input of the mixer from the tunable oscillator.

179. (Previously Presented) The CMOS integrated circuit of claim 172 wherein the track and hold circuit comprises a transistor having an input node coupled to the first input of the mixer and an output node coupled to the output of the mixer, and a current source coupled to the output of the mixer, the current source being adapted for control by a signal applied to the second input of the mixer.

180. (Previously Presented) The CMOS integrated circuit of claim 179 wherein the current source comprises a second transistor having a gate coupled to the first input of the mixer, a drain coupled to the output of the mixer, and a source, and wherein the bandpass circuit comprises a capacitor coupled to the output of the mixer and an inductor coupled to the drain of the second transistor.

181. (Previously Presented) The CMOS integrated circuit of claim 180 wherein the capacitor and inductor cooperate to provide a time constant related to a signal frequency applied to the first input of the mixer from the tunable oscillator.

182. (Previously Presented) A transmission system, comprising:

a transmitter including,

a tunable oscillator having a tuning input,

a subsampling mixer having a first input coupled the oscillator, a second input, and an output, and

a phase detector having a first input coupled to the mixer output, a second input, and an output coupled to the tuning input; and

a local oscillator coupled to the second input of the mixer.

183. (Previously Presented) The transmission system of claim 182 wherein the oscillator comprises a voltage controlled oscillator.

184. (Previously Presented) The transmission system of claim 182 wherein the transmitter further comprises a bandpass filter coupled between the subsampling mixer output and the first input of the phase detector.

185. (Previously Presented) The transmission system of claim 184 wherein the transmitter further comprises a limiter coupled between the bandpass filter and the first input of the phase detector.

186. (Previously Presented) The transmission system of claim 182 wherein the transmitter further comprises a charge pump coupled between the phase detector output and the tuning input of the oscillator.

187. (Previously Presented) The transmission system of claim 182 wherein the transmitter further comprises a loop filter coupled between the phase detector output and the oscillator tuning input.

188. (Previously Presented) The transmission system of claim 182 wherein the oscillator comprises a voltage controlled oscillator, the transmission system further comprising a bandpass filter coupled to the mixer output, a limiter coupled between the bandpass filter and the first input of the phase detector, a charge pump coupled to the phase detector output, and a loop filter coupled between the charge pump and the tuning input of the oscillator.

189. (Previously Presented) The transmission system of claim 171 wherein the mixer comprises a track and hold circuit coupled to the inputs of the mixer and the output of the mixer, and a bandpass circuit coupled to the first input of the mixer and the output of the mixer.

190. (Previously Presented) The transmission system of claim 189 wherein the mixer further comprises an input circuit disposed between the first input of the mixer and the track and hold circuit.

191. (Previously Presented) The transmission system of claim 189 wherein the mixer further comprises a buffer disposed between the track and hold circuit and the output of the mixer.

192. (Previously Presented) The transmission system of claim 189 wherein the bandpass circuit comprises an inductor coupled to the first input of the mixer and a capacitor coupled to the output of the mixer.

193. (Previously Presented) The transmission system of claim 189 wherein the track and hold circuit comprises a switch between the first input of the mixer and the output of the mixer, the switch being adapted for control by a signal applied to the second input of the mixer from the local oscillator.

194. (Previously Presented) The transmission system of claim 193 wherein the switch comprises a transistor having a gate coupled to the second input of the mixer, a source coupled to the first input of the mixer, and a drain, and wherein the bandpass circuit comprises a capacitor coupled to the drain, and an inductor coupled to the source.

195. (Previously Presented) The transmission system of claim 194 wherein the capacitor and inductor cooperate to provide a time constant related to a signal frequency applied to the first input of the mixer from the tunable oscillator.

196. (Previously Presented) The transmission system of claim 189 wherein the track

and hold circuit comprises a transistor having an input node coupled to the first input of the mixer and an output node coupled to the output of the mixer, and a current source coupled to the output of the mixer, the current source being adapted for control by a signal applied to the second input of the mixer.

197. (Previously Presented) The transmission system of claim 196 wherein the current source comprises a second transistor having a gate coupled to the first input of the mixer, a drain coupled to the output of the mixer, and a source, and wherein the bandpass circuit comprises a capacitor coupled to the output of the mixer and an inductor coupled to the drain of the second transistor

198. (Previously Presented) The transmission system of claim 197 wherein the capacitor and inductor cooperate to provide a time constant related to a signal frequency applied to the first input of the mixer from the tunable oscillator.

199. (Previously Presented) A complimentary metal oxide semiconductor (CMOS) transmitter system; comprising:

first oscillator means for generating a first signal having a tunable frequency, the first oscillating means comprising tuning means for tuning the frequency of the first signal;

mixer means for mixing the first signal with a second signal to produce a mixed signal;

detector means for detecting a phase difference between the mixed signal and an input signal, and generating an error signal which is a function of the phase difference, the tuning means being responsive to the error signal; and

second oscillator means for generating the second signal.

200. (Previously Presented) The CMOS transmitter system of claim 199 wherein the first oscillator means comprises a voltage controlled oscillator, the tuning means being responsive to a voltage of the error signal.

201. (Previously Presented) The CMOS transmitter system of claim 199 further comprising filter means for filtering the mixed signal before being applied to the detector means,

the filtered mixed signal comprising a difference frequency between the tuned frequency of the first signal and a frequency of the second signal.

202. (Previously Presented) The CMOS transmitter system of claim 201 further comprising means for limiting the filtered mixed signal from the filter means before being applied to the detector means.

203. (Previously Presented) The CMOS transmitter system of claim 199 further comprising means for sourcing current to the tuning means responsive to the error signal.

204. (Previously Presented) The CMOS transmitter system of claim 199 further comprising means for filtering the error signal from the detecting means before being applied to the tuning means.

205. (Currently Amended) The CMOS transmitter system of claim ~~15~~ 199 wherein the first oscillator means comprises a voltage controlled oscillator, the tuning means being responsive to a voltage of the error signal, the CMOS transmitter system further comprising filter means for filtering the mixed signal before being applied to the detector means, the filtered mixed signal comprising a difference frequency between the tuned frequency of the first signal and a frequency of the second signal, means for limiting the filtered mixed signal from the filter means before being applied to the detector means, current means for sourcing current to the tuning means responsive to the error signal, and means for filtering the current sourced error signal from the current means before being applied to the tuning means.

206. (Previously Presented) The CMOS integrated circuit of claim 199 wherein the mixer means comprises a subsampling mixer.

207. (Previously Presented) The CMOS integrated circuit of claim 206 wherein the subsampling mixer comprises track and hold means for tracking and holding the first signal in response to the second signal, and limiting means for limiting the response of the track and hold means to a frequency band, the first signal being within the frequency band.

208. (Previously Presented) The CMOS integrated circuit of claim 207 further comprising means for buffering first signal before being applied to the track and hold means.

209. (Previously Presented) The CMOS integrated circuit of claim 207 wherein the limiting means comprises an inductor and capacitor each being coupled to the track and hold means.

210. (Previously Presented) The CMOS integrated circuit of claim 207 wherein the track and hold means comprises a switch in a path of the first signal, the switch being controlled by the second signal.

211. (Previously Presented) A transmitter system, comprising:

first oscillator means for generating a first signal having a tunable frequency, the first oscillating means comprising tuning means for tuning the frequency of the first signal;

mixer means for mixing the first signal with a second signal to produce a mixed signal;

filter means for filtering the mixed signal to generate a difference signal between the frequency of the first signal and a harmonic of the second signal; and

detector means for detecting a phase difference between the filtered mixed signal and an input signal, and generating an error signal which is a function of the phase difference, the tuning means being responsive to the error signal; and

second oscillator means for generating the second signal.

212. (Previously Presented) The transmitter system of claim 211 wherein the first oscillator means comprises a voltage controlled oscillator, the tuning means being responsive to a voltage of the error signal.

213. (Previously Presented) The transmitter system of claim 211 wherein the second signal comprises a frequency different from the frequency of the first oscillator means

214. (Previously Presented) The transmitter system of claim 211 further comprising means for limiting the filtered mixed signal from the filter means before being applied to the detector means.

215. (Previously Presented) The transmitter system of claim 211 further comprising means for sourcing current to the tuning means responsive to the error signal.

216. (Previously Presented) The transmitter system of claim 211 further comprising means for filtering the error signal from the detecting means before being applied to the tuning means.

217. (Previously Presented) The transmitter system of claim 211 wherein the first oscillator means comprises a voltage controlled oscillator, the tuning means being responsive to a voltage of the error signal, and the second signal comprises a frequency different from the frequency of the first oscillator means, the transmitter system further comprising means for limiting the filtered mixed signal from the filter means before being applied to the detector means, current means for sourcing current to the tuning means responsive to the error signal, and means for filtering the current sourced error signal from the current means before being applied to the tuning means.

218. (Previously Presented) The transmitter system of claim 211 wherein the mixer comprises track and hold means for tracking and holding the first signal in response to the second signal, and limiting means for limiting the response of the track and hold means to a frequency band, the first signal being within the frequency band.

219. (Previously Presented) The transmitter system of claim 218 further comprising means for buffering first signal before being applied to the track and hold means

220. (Previously Presented) The transmitter system of claim 218 wherein the limiting means comprises an inductor and capacitor each being coupled to the track and hold means.

221. (Previously Presented) The transmitter system of claim 218 wherein the track and hold means comprises a switch in a path of the first signal, the switch being controlled by the second signal.